

# Thermal springs – an overview on thermal waters

published in Beauty Forum 2021 (1), 70-72

The water balance in the skin is extremely important not only for the skin but for the whole body. In the evolutionary process it was vital to survival to build up a barrier against dehydration. Keeping this protective skin barrier in a healthy and intact state still is one of the major tasks of skin care.

**W**ater is not identical with other water, a spring is not like another spring and a thermal spring is a very particular phenomenon. First of all, the term should be defined: we speak of a thermal spring when water heated up to at least 20 °C comes to the surface. The thermal water is heated deep down below the surface of the earth either through the geothermal energy far below or through local volcanic activity. When passing through the different rock layers the water absorbs gases due to the high pressure and large quantities of different minerals due to the high temperature. It is called curative water when it contains at least one gram of solid matter per litre and a healing effect has been proven. Only after being bottled it turns into a healing product requiring licensing according to the Medicinal Products Law (German Arzneimittelgesetz – AMG). External application and

inhalation in the form of an aerosol is not affected thereby.

### Components and production

The most frequent mineral components are sodium- and potassium salts (alkali metals), calcium- and magnesium salts (alkaline earth metals) as well as low concentrations of aluminum-, iron-, manganese-, copper- and zinc salts of hydrochloric acid (chlorides), hydrobromic acid (bromides) hydroiodic acid (iodides), sulphuric acid (sulphates), hydrofluoric acid (fluorides), carbonic acid (hydrogen carbonates, carbonates) and silicic acid (silicates). Iron components become noticeable by forming iron hydroxide (brown colour) at the exit, a phenomenon caused by the contact with atmospheric oxygen. Volcanic sulphur can form yellow residues or long and sharp crystals. In

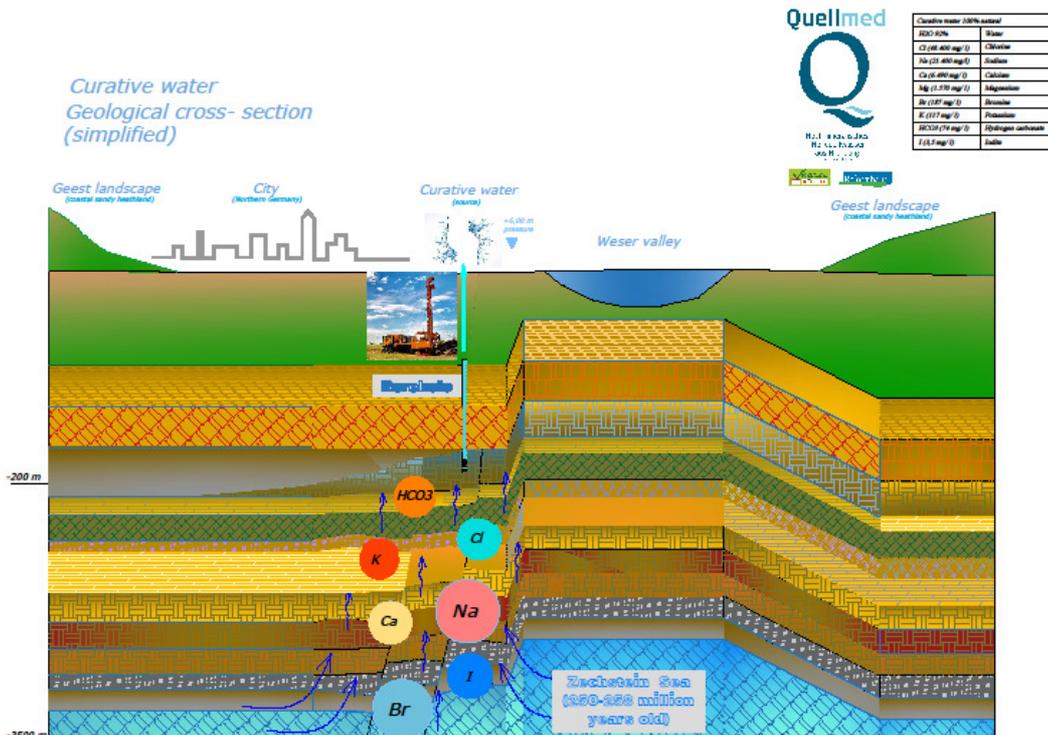


Figure: Middle Weser mineral springs (Mittelweser Heilquellen GmbH)

its reduced form (hydrogen sulphide, sulphides) it is foul-smelling and in oxidised form (sulphur dioxide, sulphites) it has a pungent odour or it forms the already mentioned odourless sulphates.

There are different ways of gaining thermal waters, either by proper catchment of existing springs on the surface of the earth or by drillings as for instance at the Middle Weser mineral springs, Nienburg (Lower Saxony) where the water is gained at 200 meters below surface and even partly stems from areas in a depth of 3,500 meters (see diagram).

Such kinds of drillings are not without risks as the numerous damages to properties at Staufeu (Upper Rhine Valley, Baden-Wuerttemberg) can prove. In this particular case an anhydride layer was opened up causing an unexpected and extensive increase in volume in the sub-surface due to the hydration of water-free gypsum.

Thermal waters have various benefits:

- Drinking cures, if the contained minerals have an oral curative effect.
- Physiotherapy: because of the low stress in water, rehabilitation trainings in water are beneficial, also in the context of chronic complaints of the musculoskeletal system. The heat causes a relaxation of muscles and the connective tissue. Exercises that are also found in the wellness field are swimming, treading water and gymnastics – where applicable in combination with massages.
- Bathing in high temperature thermal spas can support the natural healing processes of the body even if the temperatures do not achieve the artificially caused overheating of the body in hyperthermia treatments. Similar to natural fever reactions, full-body and local hyperthermia procedures are utilized for healing processes as for instance in the treatment of tumors. By the same token and curiously enough there are also concerns on the part of the medical staff insisting that thermal baths can activate tumours.
- Inhalations of thermal waters generally only play a role if applied in combination with plants, as for instance in the form of fir twigs, herbal extracts or essential oils. In these cases the thermal water is an adjuvant (carrier) and practically has no effects to speak of.

### Thermal water and skin

There are various and individually very different effects of thermal waters on the skin. High temperature stimulates the microcirculation and hence the metabolism. The effects can be compared with sauna effects where the own sweat is the external medium and hence the sapping effects of water theoretically is lower. Due to the swelling of the skin, the skin barrier is more permeable for substances that are washed out of the skin but also for external substances contained in the thermal water.

After bathing in thermal water, the transepidermal water loss (TEWL) still is increased for some time until the skin barrier has regenerated. Applying suitable barrier-active lotions or creams can accelerate the regeneration. Suitable compositions are such with barrier-identical or barrier-similar substances as for instance phytosterines (cholesterol-analogous), ceramides, fatty acids – possibly also in bound form – as well as squalene, resp. squalane in the form of a lamellar structure. Allergenic components such as preservatives and perfumes as well as emulsifiers are counterproductive because of the augmented absorbing capacity of the skin. Also the skin flora that likewise has to regenerate is affected. An important item with bathing is the prevention of infections and particularly mycoses that have an easy job with the increased permeability of the skin barrier. In this context it is important to immediately and carefully dry the skin and in particular the spaces between the toes. It is not required to rinse the remainders of a salty bath, though. On the contrary, it helps support the natural moisturizing factor (NMF) of the skin.

The salts of thermal water often have an effect on cornification- and barrier disorders as for instance psoriasis and neurodermatitis. On a local level pure air and radiation can play a synergistic role. Such influences are well-known from the Dead Sea area although it is not a matter of thermal water in the narrower sense of the term.

Sulphurous thermal springs of volcanic origin are a particular issue, as for instance found at the Aeolian Islands, which partly empty below the ground into the coastal marine waters. Various effects are attributed to these springs. In this context anti-oxidative effects are frequently mentioned.

It is a fact that sulphides and hydrogen sulphide are easily absorbed by keratin and that they partly break sulphur bridges in the proteins in this process, similar to the thioglycolic acid process known in the context of perms. Hydrogen sulphide is emitted again but only after a certain time so that the typical annoying odour is lasting for quite some time.

Other thermal waters contain iodine, radon (radioactive) or carbon dioxide (CO<sub>2</sub>). They are rather used for indications around the body and are less relevant for the skin.

### **Thermal water cosmetics**

Due to the known effects of minerals on the skin meanwhile there are many cosmetic preparations, either as a lotion, spray or cream, in which the water phase is replaced by thermal water. Also medical products are among such preparations which, other than cosmetic preparations, can promise healing results although the compositions are almost identical. It should also be mentioned that the legal framework for medical products (under the medical device law) still is less strict than for cosmetic products.

Thermal waters in cosmetics are useful when they contain substances with beneficial effects after topical application. In practice, the use of thermal water is more complicated since sometimes it cannot be directly used in its unprocessed state. If iron salts are contained they have to be eliminated before processing as they can show pro-oxidative effects in combination with other ingredients in the finished product. Since the processing of thermal water can involve changes in the concentration, the mineral substances are alternatively isolated in pure form after eliminating the iron ions and suspended solids (filtration level). This procedure facilitates the transport to the cosmetic manufacturers and avoids preservative measures. The mineral substances then are again dissolved in demineralised water in their original concentrations during the processing of creams or lotions.

A certain placebo effect cannot be excluded with such preparations, in particular, if the history of the thermal water is mentioned during sales conversations. It improves the wellbeing and the effects often are described as vitalising and energising with corresponding terms in the product name.

The reproductions of thermal waters and compositions similar to the Dead Sea Water are sold in the form of bath supplements. They are only used for balneological or therapeutic purposes.

Dr Hans Lautenschläger